TERRAMODEL NOTE 1
CAD Fundamentals

Objective:

The objective of this TM Note is to introduce the TERRAMODEL menu structure and basic CAD concepts to the user through hands on training exercises.

Developed by:

Robert E. Sullivan
Karen S. Dvorsky
Stephen J. Moran

January 1995

Revised for Windows by:

Jason Sall

November 1998

TERRAMODEL Note 1--CAD Fundamentals

A. Selecting a Command

TERRAMODEL commands may be selected in two ways:

1. By selecting the command from the menu with the mouse, [ ].
2. By typing the command at the bottom line of the screen. This is called the command bar. Many of the commands cannot be accessed using the command bar. (See Figure 1-1)

Note: On-line help menus can be accessed at any time by pressing the **{F1}** key. This works for nearly all Windows programs. If the user presses the **{F1}** key while running a command, TERRAMODEL will bring up the help screen that describes the command that is being used.

B. Using the Mouse

The buttons on the mouse have specific uses in TERRAMODEL:

1. The cross hairs displayed on the screen (See Figure 1-1) are controlled by moving the mouse. Moving the mouse above the screen allows the selection of menu items and removes the cross hairs from display.

2. A pick box is displayed on the screen after various commands are selected. The pick box, like the cross hairs, is moved by the mouse and can be used to select menu items and objects on the screen.

3. The left button is the Select button. This is the button most often used. Move the mouse until the pointer is over the menu item and then select the item by clicking the left button. The symbol **[ ]** will be used to represent selecting an object or menu item with the left button of the mouse. The words “left-click” will also be used when an object is to be selected with the left mouse button.

4. The right button is an options button. While using a command, pressing the right button will display a pop-up menu with different options relating to the command being used. For example, if the user is drawing a pline, pressing the right button will bring up the point snap menu. The words “right-click” will be used to identify when to press the right mouse button.

C. Menus

There are three types of Menus used in TERRAMODEL:

1. The Pull-down menus are located horizontally across the top of the screen. Nearly all of the TERRAMODEL commands can be accessed through the pull-down menus. These menus can be accessed using the mouse. The pull-down menus can also be accessed by pressing **{ALT}** and then the underlined letter of the desired menu. A few commands cannot be accessed through the pull down menus

because they were created after the menus were created. These commands must be typed in the command bar to be accessed.

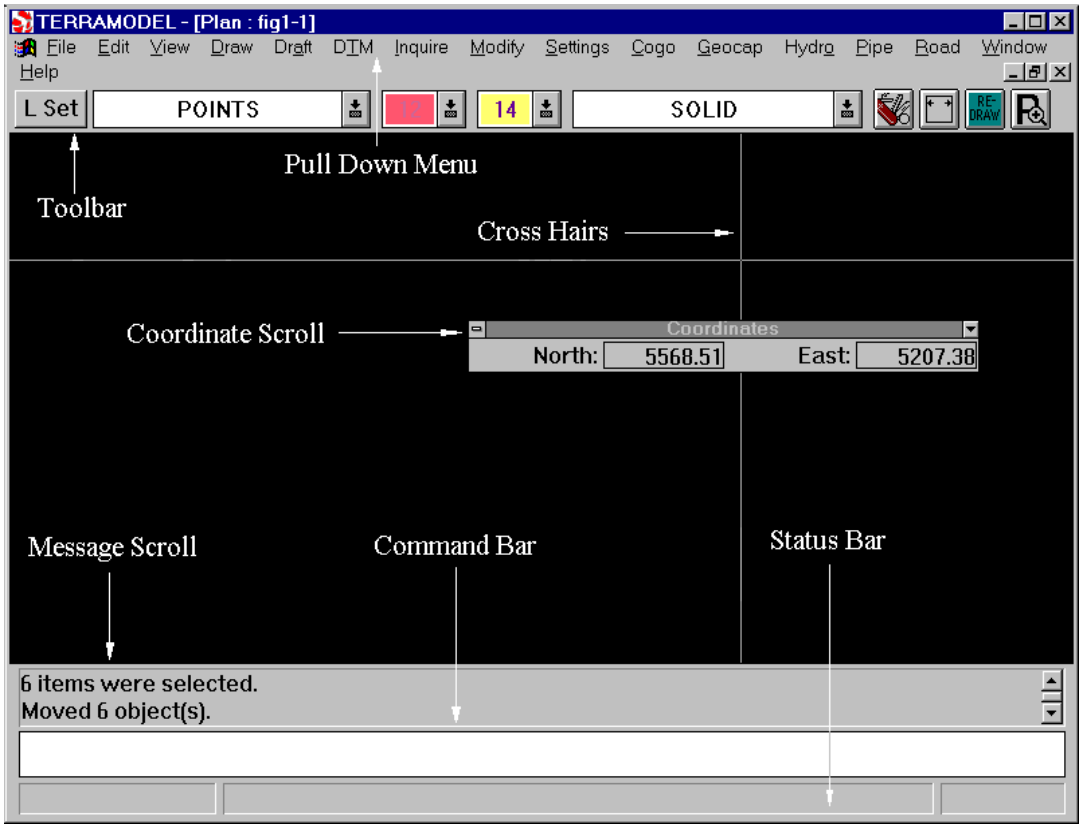


Figure 1-1

Note: Nearly all of the commands for TERRAMODEL are shown in the menus. However, only the commands for the modules available (with the hardware lock) can be executed. Whenever a command is selected that is not available with the hardware lock present, a message will appear at the bottom of the screen stating *Another TERRAMODEL Module performs this Command.*

2. Pop-up menus appear on the screen after pressing the right mouse button as explained previously in section 4 of “Using the Mouse”.

Figure 1-2
(Point Snap Mode Pop-up Menu)

3. Dialog boxes aren’t technically menus because they allow the user to do more than just select something. A dialog box gives the user a way to interact with the application. The dialog box usually contains one or more controls that display static text or graphics, or let the user specify information. For example, left-clicking on the L Set button on the toolbar brings up the Layer Settings dialog box. This dialog box allows the user to alter layer settings such as color, line type, name and visibility.

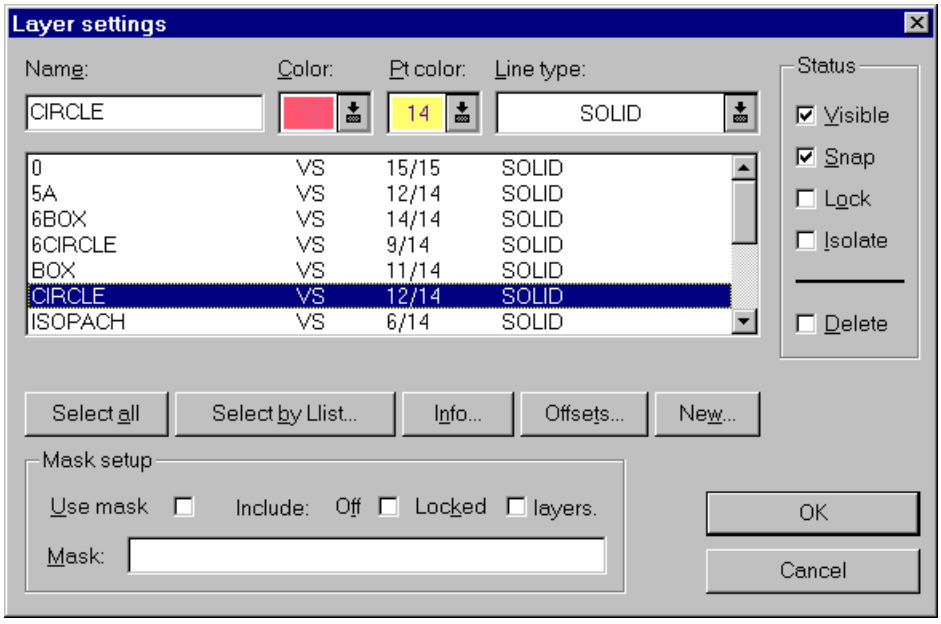


Figure 1-3
(Layer Settings Dialog Box)

D. **TERRAMODEL Concepts**

An understanding of the following concepts will make learning and using the software much easier:

1. Coordinate System (Plan Viewing Mode)

   TERRAMODEL uses the (**Northing, Easting**) coordinate system in plan view. Northings are the vertical coordinate and Eastings are the horizontal coordinates on the screen. Negative coordinates are acceptable. To enter coordinates of a point, always enter the Northing first, followed by a comma (or space), then the Easting. The coordinate scroll will always appear when TERRAMODEL is started. To view the coordinates of the cross-hairs simply look at the coordinate scroll. The coordinate scroll can be moved around the screen or minimized to get it out of the way when drafting. The coordinate scroll will show the appropriate coordinate system for the active view. (See Figure 1-1)

2. Layers

   The use of layers is a very powerful feature of TERRAMODEL. Layers can be thought of as separate overlays containing objects that can be displayed or not displayed. For example, contour lines may be on one layer, survey points on another, a centerline on another, and a dam layout on another. By displaying the objects on all of these layers, the user would see the dam layout, centerline, survey points, and contour lines all on the screen (preferably in different colors). Or, by displaying only the centerline layer and contour layer, only the centerline and contours would be displayed. In the DOS version of TERRAMODEL, layers were turned off when the user did not want them to be visible on the screen. In the Windows version it is recommended that the layers be made invisible (using the Layer Settings dialog box), instead of turning it off.

   The user selects a name, colors, and line type for each layer created.

3. Selecting Objects

   Many commands require the user to select objects. When a command requires that objects be selected, a select control command bar will appear at the bottom of the screen. The select control lets the user select one or more object types. When the focus is on the select control (i.e. when it is highlighted) the user can select objects that are of the type shown in the control.

   The initial select option that is shown is Record (database record). That means it will select whatever objects the user selects with the pickbox. Objects can be chosen by color, layer, window, name, etc. When the focus is on the select control, the user can right-click anywhere in the drawing area to access a pop-up menu that contains the different object types the user can choose from. Typing the first letter of the object type will also allow the user choose objects of that

type. The user must then left-click on the small button next to the select control window to access the appropriate dialog box.

For example, say the user wants to erase by layer. From the pull down menu choose [Edit]-[Delete]. This will bring up the select control command bar. The word Record will be in the select control window. Right-click anywhere in the drawing area to access the pop up menu, then choose Layer from that menu OR simply type the letter L on the keyboard without accessing the pop up menu. The word Layer should now appear in the select control window instead of the word Record. The user can now left-click on the small box next to the select control window to access the Select by layer(s) dialog box. This dialog box allows the user to select the layer(s) to be erased. The user can also simply left-click on any object on the screen that is in the layer that is to be erased. This is done in place of using the Select by layer(s) dialog box.

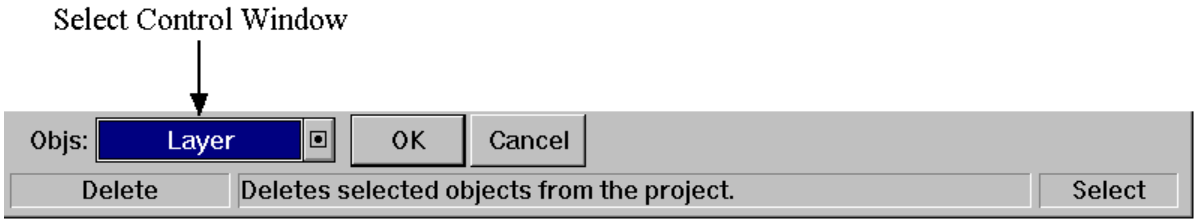


Figure 1-4
(Select Control Command Bar and Status Bar)

NOMENCLATURE

The following is a list of notations used for all TERRAMODEL NOTES.

[ ] Brackets indicate selecting a command, object, screen position, or menu with the left mouse button.

[Draw] Words within the brackets that are not bold type are used to identify menu headings in the pull down menu. The menu heading Draw should be selected with the left mouse button. Some commands are located in submenus. For example, [Draw]–Pline–[Line]. There are no brackets around Pline because the submenu containing Line will appear without clicking on the word Pline. Anytime there is a small arrowhead next to a command in a menu, there is a submenu containing more specific commands.

[Save] Words within the brackets that are bold are used to identify buttons on a dialog box or command bar. For example, when the user begins a new project a dialog box will appear. This dialog box allows the user to enter the name and location of the drawing file. Left-clicking on the save button after entering the required information will save the file and remove the dialog box from the screen.

Note: As with many Windows programs, commands can be accessed in multiple ways. As with the DOS version, many commands can be accessed by typing an alias in the command bar. The alias list can be personalized so that the same command that was used with the DOS version can be used with the Windows version. The author does not recommend doing this. In this manual, nearly every command will be accessed from the pull-down menu. The user can experiment with the software to determine which aliases will work. Toolboxes can also be created which contain icons that the user left-clicks on to access the command. The responsible field engineer will train each user on the creation and use of aliases and toolboxes, as well as basic Windows commands.

↵ This symbol is used to indicate the Enter key on the keyboard.

125 or **CL** Bold capital letters indicate that the user should type the information in the command bar or the active dialog box. It can usually be typed in either upper or lower case letters, but there are instances when the program is case sensitive.

{ESC} {F6} The curly braces are used to identify special keys on the keyboard, for example the escape key or function keys.

TRAINING EXERCISES

To load TERRAMODEL and begin a new project:

Once Windows has loaded, double left-click the TERRAMODEL icon that is on the desktop. The lock must be attached to the parallel port before the program will start up.

Once TERRAMODEL is running,

[File]-[New project]

The user must then choose the folder to put the drawing in.

In the File name window, type the name that the file is to be saved to.

[Save]

1. Draw a circle on layer CIRCLE and a box outside of the circle on layer BOX.

First, create new layers named BOX and CIRCLE

On the toolbar, [L Set] (This brings up the Layer Settings dialog box)

[New] (This will bring up the New Layer dialog box)

In the name window, **BOX**

Choose color 11 for the objects and color 14 for the points. The list of colors to choose from can be accessed by left-clicking on the down arrow next to the color. This brings up the Color Selection dialog box. Once the color has been chosen, **[OK]**. The user will then be returned to the New Layer dialog box.

Choose the solid line type. The list of line types to choose from can be accessed by left-clicking on the down arrow next to the Line type window.

[OK] (This will create the layer and turn off the New Layer dialog box)

[New] (This will turn on the New Layer dialog box again)

In the name window, **CIRCLE**

Choose color 12 for the objects and color 14 for the points.

Choose the solid line type.

[OK] (This will create the layer and turn off the New Layer dialog box)

[OK] (This will turn off the Layer Settings dialog box)

Draw a circle on layer CIRCLE.

The current layer and its properties are always shown in the toolbar at the top of the screen. If the current layer is not CIRCLE, change it by left-clicking on the down arrow just to the right of the layer name. This will bring up the Layer Selection dialog box. Left-click on the layer that is to be current (so it is highlighted), and then **[OK]**.

[Draw]-Pline-[Circle] (This will bring up the circle command bar at the bottom of the screen)

Select a point near the center of the screen and [ ]

In the radius window, **25**

[OK]

The circle was stored on layer CIRCLE.

Draw a box around the circle on layer BOX.

Change the current layer to BOX by left-clicking on the down arrow next to current layer name in the toolbar. Left-click on the layer name BOX, and then **[OK]**.

To draw the box:

[Draw]-Pline-[Box]

[ ] select the location of the upper left corner

[ ] select the location of the lower right corner

[OK]

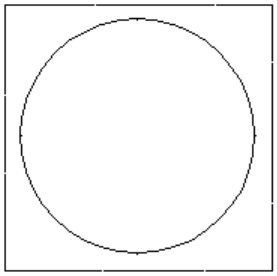


Figure 1-5

2. Move the circle outside of the box and rotate the box 45 degrees.

To move the circle:

[Modify]-[Move] (This will bring up the move command bar)

Leave the select control on Record

[ ] select the circle

Make sure the focus is in the From window (the user can either left-click on the window or **{Tab}** to move the focus into the From window) and [ ] select a point in or near the circle

[ ] select a point to the right of the box (The focus will have automatically moved into the To window)

The command bar will disappear without having to hit the OK button

To rotate the box:

[Modify]-[Rotate] (This will bring up the rotate command bar)

Leave the select control on Record and [ ] select the box

Make sure the focus is in the Around window, and [ ] select a point near the center of the box

With the focus in the Angle window, **45**

↵ or **[OK]**

To zoom in on the box:

Note: The "window" command in the DOS version is the same as the "zoom" command in the Windows version.

[View]-[Zoom] (This will bring up the zoom command bar)

With the focus in the From window, [ ] select a point above and to the left of the box

With the focus in the To window, [ ] select a point below and to the right of the box

The command bar will disappear without having to hit **[OK]**

Note: Many times the focus will automatically move to the window that the user wants it to be in. Also, a command will sometimes terminate itself after the user has supplied all of the required information (without having to hit the OK button). After a short while of working with the program, the user will know when the focus has to be moved manually and when a command has to be terminated manually.

To show the previous display:

[View]-[Previous view]

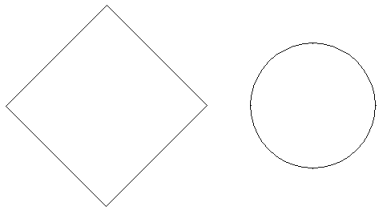


Figure 1-6

3. Draw a line through the box and the circle, and erase the line segments inside the circle and box. Store the line on a new layer named LINE.

On the toolbar, **[L Set]**

On the Layer Settings dialog box, **[New]**

In the Name window of the New Layer dialog box, **LINE**

Set the object color to 13 (Left-click the down arrow next to the object color window and choose color 13. Then **[OK]**)

On the New Layer dialog box, **[OK]**

On the Layer Settings dialog box, **[OK]**

Change the current layer to LINE:

Left-click on the down arrow in the toolbar that is next to the layer name (This brings up the Layer Selection dialog box.

Left-click on the layer name LINE so that it is highlighted

[OK]

To draw the pline:

[Draw]-Pline-[Line] (This brings up the pline command bar)

[ ] select a point left of the box

[ ] select a point right of the circle

{ESC} to break out of the pline command or **[Close]** on the command bar

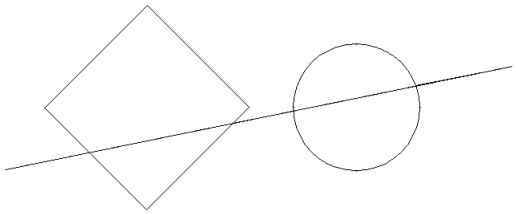


Figure 1-7

To erase the portion of line inside the box, one method is to break the line into segments and erase the segment within the box:

[Edit]-[Clip] (This will bring up the clip command bar)

Left-click the down arrow next to the Mode window and choose the Break option or simply press the letter B on the keyboard when the focus is on the mode window (i.e. when the mode window is blue)

Move the focus to the Bound control window by either left-clicking on the window or by **{TAB}**. Leave the Bound control on Record.

[ ] select the box on the screen

Move the focus to the Object control window. Leave the Object control on Record.

[ ] select the pline

On the command bar **[OK]**

The line has been broken into three segments, so the line segment inside the box can be erased:

[Edit]-[Delete]

Leave the object control on Record, and [ ] select the line segment inside the box

[OK]

To freshen up the display:

[View]-[Redraw]

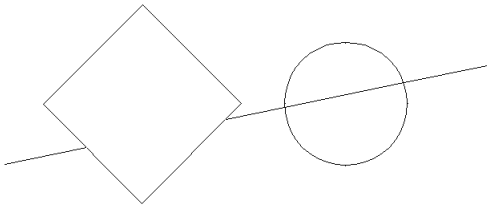


Figure 1-8

To erase the line segment inside the circle, another method will be used:

[Edit]-[Clip] (This will bring up the clip command bar)

Leave the mode control on Inside.

Move the focus to the Bound control window by either left-clicking on the window or by **{TAB}**. Leave the Bound control on Record.

[ ] select a point on the circle

Move the focus to the Object control window. Leave the Object control on Record.

[ ] select the pline

On the command bar **[OK]**

The line segment inside the circle will be gone.

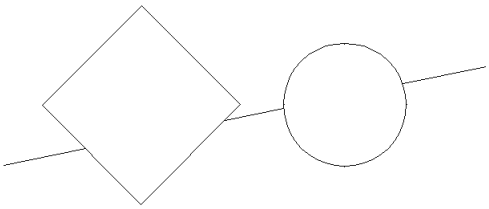


Figure 1-9

Note: If a mistake has been made, the user can undo the last command used.

To undo the erasing of the line segment inside the circle:

[Edit]-[Undo]

The segment inside the circle reappears. Using UNDO once more will bring back the segment within the box:

[Edit]-[Undo]

Note: The UNDO command can also be accessed using **{F12}** on the keyboard.

Likewise, using the REDO command twice can be used to redo each undo.

[Edit]-[Redo]

[Edit]-[Redo]

4. Compute the area of the box and circle and find the length and bearing of the line segment between the box and circle.

To compute the area of a closed object such as the box:

[Inquire]-[Area/perimeter]

[ ] select the box

The area (in square feet and acres) and the perimeter (in feet) will be shown in the Message Scroll

[Close] or **{ESC}** to exit the command

Repeat the process for the circle:

Hint: A short-cut to repeat the last command used is to hit the space-bar on the keyboard. This selects the last command used.

[Inquire]-[Area/perimeter]

[ ] select the circle

The area (in square feet and acres) and the perimeter (in feet) will be shown in the Message Scroll

[Close] or **{ESC}** to exit the command

To find the length and bearing of the line segment:

[Inquire]-[Inverse]

In the Mode control select the Segment option instead of the Points option by left-clicking on the down arrow next to the window

[ ] select the line segment between the box and the circle

The bearing and length will be displayed on the Message Scroll.

[Close] or **{ESC}** to exit the command

Note: When selecting the line segment for the inverse command, where the user selects the line will determine which possible bearing is listed. If the user selects the left side of the segment, one of the two possible bearings will be listed. If right side of the segment is selected, the other possible bearing, which is the opposite of the first, will be listed.

To list the objects to the screen:

[Inquire]-[List]

[Objs]

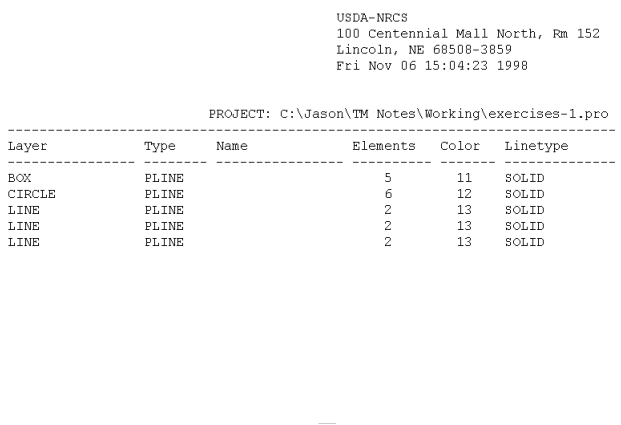
Change the Select Control to Window. This can be done by typing the letter W when the focus is on the select control window or by right-clicking anywhere in the drawing area while the focus is on the Select Control window and then choosing window from the pop-up menu.

[ ] select a point left and above the objects

[ ] select a point right and below the objects

[OK]

A text editor will then appear on the screen listing the information about the objects. The document can be manipulated, saved, and printed just like any other word processing document. If the user doesn't want to save the information, then simply close the document by [File]-[Close] on the text editor's pull down menu.



USDA-NRCS
100 Centennial Mall North, Rm 152
Lincoln, NE 68508-3859
Fri Nov 06 15:04:23 1998

PROJECT: C:\Jason\TM Notes\Working\exercises-1.pro

Layer	Type	Name	Elements	Color	Linetype
BOX	PLINE		5	11	SOLID
CIRCLE	PLINE		6	12	SOLID
LINE	PLINE		2	13	SOLID
LINE	PLINE		2	13	SOLID
LINE	PLINE		2	13	SOLID

Figure 1-10

To completely exit the List command (to get rid of the List command bar), **[Close]** or **{ESC}**

5. Isolate the LINE layer, extend the outside lines outward by 25', and draw parallel lines 25' from the lines.

To isolate the layer:

On the toolbar, **[L Set]** (This will open the Layer Settings dialog box)

Highlight the layer name LINE by left-clicking on it

Left-click on the small box to the left of the word Isolate (this will put a check mark in the box)

[OK]

To extend the lines:

[Edit]-[Extend]

Turn off the “To boundary” option by left-clicking on the small box (This will remove the check from the box and allow the user to enter a distance)

In the Distance window, **25**

With the focus in the Line window, [ ] select the left line segment near the left end

[Extend]

[ ] select the right line segment near the right end

[Extend]

{ESC} or **[Close]** to exit the extend command

To view all of the lines:

[View]-[All]

To draw parallel lines:

[Edit]-[Offset distance]

With the focus in the Hal window, [ ] select the left line segment

With the focus in the Dist window, **25**

With the Side window highlighted, type **R**

[Offset]

[Close] or **{ESC}** to exit the command

Note: When choosing the side to offset the line segment to, the user can left-click in the drawing area on the side of the original line that the new line is to be located. This will offset the line to that side without having to type L or R and without having to hit the Offset button.

Repeat using the Offset Distance command for the middle and right line segments.

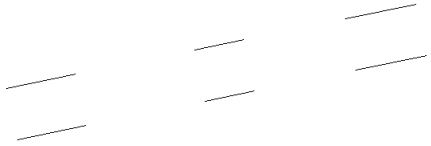


Figure 1-11

6. In this portion of the exercise the user will display the box and circle created previously, copy the box to layer 6BOX, and copy the circle to layer 6CIRCLE.

To make the BOX and CIRCLE layer visible again:

[L Set]

The only layer that the user should be able to see in the Layer Settings dialog box is the LINE layer because it is isolated. To make the other layers visible again, the user must "un-isolate" the layer by left-clicking the box next to the word isolate. This will remove the check from the box, and all of the layer names will appear in the dialog box. The layer settings will be just as they were before the layer was isolated.

[OK]

Before copying the objects on layer BOX to layer 6BOX, a layer called 6BOX must be created.

To create the layer 6BOX with object color 14:

On the toolbar, **[L Set]**

On the Layer Settings dialog box, **[New]**

On the New Layer dialog box, **6BOX**

Set the object color to 14 (Left-click the down arrow next to the object color window and choose color 14. Then **[OK]**)

On the New Layer dialog box, **[OK]**

On the Layer Settings dialog box, **[OK]**

To copy the objects on layer BOX to layer 6BOX:

[Edit]-[Copy] (This will open the Copy command bar)

Notice the small box next to the letters "Lay" in the command bar. When that box is enabled (checked), the object will be copied from its original layer to whatever the current layer is. If that box is disabled (not checked), the object will be copied on to its original layer leaving the user with two of the same object on the same layer. For this exercise, the box should be checked and the current layer should be set to 6BOX.

To make the current layer 6BOX:

In the toolbar, left-click on the down arrow next to the current layer name. This will bring up a list of the created layers to choose from.

Highlight the layer name 6BOX by left-clicking on it

[OK] (This will remove the Layer Selection dialog box)

The current layer should now be 6BOX

In the Copy command bar, change the select control to Layer. (This will copy all of the objects on layer BOX to layer 6BOX. If the user wanted to copy a specific object or objects, the select control should be left on Record. The user would then individually pick the objects to be copied.) To change the select control to Layer, either type the letter L while the focus is on the select control or right-click in the drawing area and choose Layer from the pop-up menu.

To pick the layer to be copied, left-click on the button next to the select control window (It looks like a square with a dot in the center of it). This will bring up the Select by layer(s) dialog box. Highlight the layer name BOX by left-clicking on it and then hit **[OK]**.

Hint: Remember that when the select control is set to Layer, the user can also left-click on the box to choose everything that is in the same layer as the box. This allows the user to bypass the Select by layer(s) dialog box. This also works when selecting by color, linetype, etc..

In the Copy command bar, **[OK]** (Leave the From: and To: windows blank. This will place the copied objects at the same coordinates as the original objects)

To copy the objects having the color 12 (red-orange) to Layer 6CIRCLE:

Before coping the objects that have the color 12 to the layer 6CIRCLE, the user must create a layer called 6CIRCLE

To create the layer 6CIRCLE with object color 9:

On the toolbar, **[L Set]**

On the Layer Settings dialog box, **[New]**

On the New Layer dialog box, **6CIRCLE**

Set the object color to 9 (Left-click the down arrow next to the object color window and choose color 9. Then **[OK]**)

On the New Layer dialog box, **[OK]**

On the Layer Settings dialog box, **[OK]**

To copy the objects on layer CIRCLE to layer 6CIRCLE:

[Edit]-[Copy] (This will open the Copy command bar)

Again, the box next to “Lay” needs to be checked and the current layer needs to be set to 6CIRCLE.

To make the current layer 6CIRCLE:

In the toolbar, left-click on the down arrow next to the current layer name.

Highlight the layer name 6CIRCLE by left-clicking on it

[OK] (This will remove the Layer Selection dialog box)

The current layer should now be 6CIRCLE

In the Copy command bar, change the select control to Color. (This will copy all of the objects that are a specified color to layer 6CIRCLE. To change the select control to Color, either type the letter C while the focus is on the select control or right-click in the drawing area and choose Color from the pop-up menu.

To pick the color of the objects to be copied, left-click on the button next to the select control window (It looks like a square with a dot in the center of it). This will bring up the Select by Color(s) dialog box. Highlight the color 12 by left-clicking on it and then hit **[OK]**.

In the Copy command bar, **[OK]** (Leave the From: and To: windows blank. This will place the copied objects at the same coordinates as the original objects)

The user should now have 2 boxes and 2 circles. It will only look like 1 box and 1 circle because the new box and new circle are directly on top of the original box and the original circle.

7. Move the objects on layers 6BOX and 6CIRCLE 100 feet downward

[Modify]-[Move]

Set the select control to Layer

Left-click on the button (the square with the dot in the center) next to the select control window to select the layers to move

Highlight the layer name 6BOX by left-clicking on it. Then, while holding **{CTRL}**, left-click on the layer name 6CIRCLE. Now both of the layer names 6BOX and 6CIRCLE should be highlighted.

[OK]

While the focus is in the From window, [ ] select any point in the drawing area. (The focus has to be moved from the select control window to the From window either by **{TAB}** or by left-clicking in the From window.)

With the focus in the To window, right-click anywhere in the drawing area to bring up the object snap pop-up menu. Select the DxDy option by left-clicking on it.

In the Dx window, type **0**

In the Dy window, type **–100**

[OK]

Use the view all command to display all the objects on the screen:

[View]-[All]

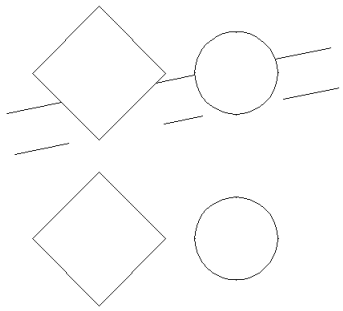


Figure 1-12

8. Use the traverse command to draw a line 100' to the north and then another 200' to the east.

Create a new layer named TRAV to store the objects on and isolate it:

[L Set]

[New]

In the layer name window, **TRAV**

Choose color 10 for the objects and color 14 for the points

[OK] (To turn off the New layer dialog box)

In the Layer settings dialog box highlight the layer name TRAV by left-clicking on it

Check the box next to the word Isolate by left-clicking on it

[OK] (To turn off the Layer settings dialog box)

Note: The traverse command creates sets rather than polylines. Sets have endpoints, polylines don't.

Before using the traverse command, draw a single point to set up on:

[Draw]-Point-[Point]

In the Location window: **500,500** (Northing and Easting of new point)

Leave the Z (elevation) and Name windows blank

[Point] (This will create the point)

[Close]

To use the traverse command:

[Cogo]-[Traverse]

With the focus in the Setup point window, [ ] select the point on the screen that was just created

In the command bar, choose the Bearing2d option. (The program defaults to the Bearing3d option so the user must left-click on the down arrow to access the different options and select Bearing2d option by left-clicking on it)

In the bearing window, **N0E**

In the distance window, **100**

Leave the vertical angle window at Z90.00 (This means a 90 degree zenith angle)

[2d] (This will create the first line and will leave the command running so the user can enter more lines)

In the bearing window, **N90E**

In the distance window, **200**

[2d]

[Close] or **{ESC}**

[Cancel] or **{ESC}**

Note: Use the display commands at any time to improve the visiblity of the objects.

Figure 1-13

9. At the right end of the horizontal line created in Example 8, draw a curve using a 130' radius and a delta angle of 120 degrees.

Using the traverse command:

[Cogo]-[Traverse]

With the focus in the Setup point window, [ ] select the point at the right end of the horizontal line

The user must now set a backsight bearing so that the software knows which direction to draw the curve.

In the command bar, choose the Backsight option (To see the options, left-click on the down arrow next to the default option and select the Backsight option by left-clicking on it. This will bring up the Backsight command bar.)

In the Bearing window, **N90W** (This is the backsight bearing)

[BackSight] (This will set the backsight bearing and return to the Traverse command bar)

In the command bar, choose the PC option (As before, the user will have to left-click on the down arrow next to the default option and select the PC option)

[PC/PI/PT] (This will bring up the Arc input properties dialog box)

In the Radius window, **130**

In the Delta window, **120**

Make sure the direction of curve is to the Right (Using the radio button)

[OK] (This will create the curve and remove the dialog box)

[Close] or **{ESC}**

[Cancel] or **{ESC}**

Hint: To determine if the direction of curve is left or right, visualize walking around the curve beginning from the setup point. Is the radius point of the curve to the left or right?

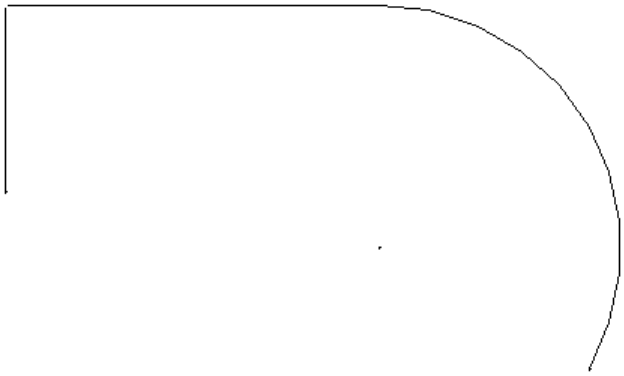


Figure 1-14

10. Repeat Step 9 using polylines. Draw a polyline north 100', and then east 200'.

Create a new layer named POLY to store the objects on, isolate Layer POLY.

[L Set]

[New]

In the layer name window, **POLY**

Choose color 14 for the objects and color 15 for the points

[OK] (To turn off the New layer dialog box)

In the Layer settings dialog box highlight the layer name POLY by left-clicking on it

Check the box next to the word Isolate by left-clicking on it

[OK] (To turn off the Layer settings dialog box)

Draw a polyline north 100', and then east 200'.

[Draw]-Pline-[Line] (This will bring up the Pline command bar)

In the Location window, **550,550**

[Create]

With the cross hairs anywhere in the drawing area, press the right mouse button. This will bring up the point snap pop-up menu.

Left-click on BrgDist on the pop-up menu (This will bring up the Bearing-Distance command bar)

In the Bearing window, **N0 00 00E** (or simply N0E)

In the Distance window, **100**

[OK] (This will create the line, remove the Bearing-Distance command bar, and return the user to the Pline command bar. The coordinates of the endpoint of the newly created line (650,550) will show up in the Location window.)

With the cross hairs anywhere in the drawing are, press the right mouse button. As before, this will bring up the point snap pop-up menu.

Left-click on BrgDist on the pop-up menu (As before, this will bring up the Bearing-Distance command bar)

In the Bearing window, **N90 00 00E** (or simply N90E)

In the Distance window, **200**

[OK] (This will create the line, remove the Bearing-Distance command bar, and return the user to the Pline command bar)

[Close] or **{ESC}** (This will remove the Pline command bar)

Figure 1-15

Note: A useful command to make a set or breakline from a polyline, or vice-versa is the Convert command which is located under [Edit]-[Convert]. However, the Convert does not change the line, but instead makes a new line over the top of the existing line. This means if a set has been converted to a polyline, both the set and the polyline will be in the drawing. If the user doesn't want both of the lines, simply enable the "Del old" checkbox. This will erase the original line.

11. At the right of the horizontal line created in Example 10, draw a curve using a Tangent of 225' with a delta angle of 120 degrees.

Draw a horizontal polyline 225' long and a polyline 225’ long at a bearing of S 30 W to serve as tangent lines.

[Draw]-Pline-[Line] (This will bring up the Pline command bar)

Right-click anywhere in the drawing area to bring up the point snap modes pop-up menu.

Choose the End option by left-clicking on it

[ ] select the right endpoint of the horizontal line

Right-click anywhere in the drawing area again to bring up the point snap modes pop-up menu.

Choose the BrgDist option by left-clicking on it

In the Bearing window; **N90E**

In the Distance window; **225**

[OK]

Again, right-click anywhere in the drawing area to bring up the point snap modes pop-up menu

Choose the BrgDist option by left-clicking on it

In the Bearing window; **S30W**

In the Distance window; **225**

[OK]

[Close] or **{ESC}**

Figure 1-16

Draw the arc

[Draw]-Arc-[Curve]

Leave the mode on Arc

With the focus in the Pline:cp window; left-click on the intersection of the two tangent lines (A new command bar will appear)

Note: If the user created the two tangents using two plines (instead of one continuous pline), the plines will have to be joined before a control point (Pline:cp) can be chosen. The Join command is under [Edit]-[Join]

Use the Tangent option (Left-clicking on the down arrow will bring up a list of options. Choose the Tangent option by left-clicking on it)

Enter a tangent length of **225** ft

[OK]

[Close] or **{ESC}**

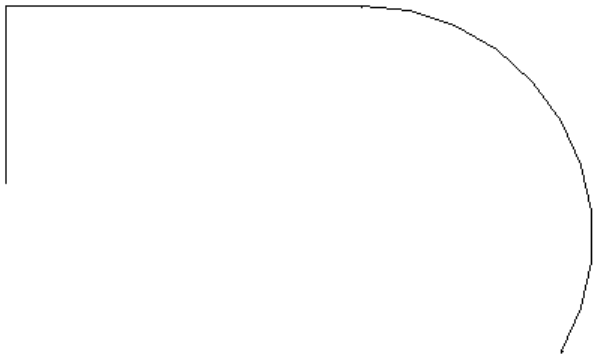


Figure 1-17

PROBLEMS

1-a. Draw a 5 sided closed object on layer 1A. Calculate the perimeter and area.

Note: For each layer created in the problems, use a different color.

Hint: To use the Close pline command, draw 4 sides of the object and then hit the Close pline button on the command bar to add the 5th line.

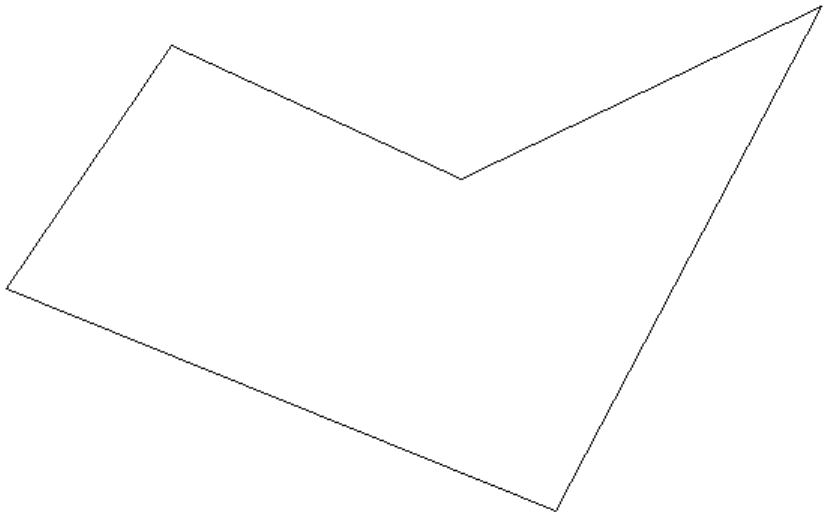


Figure 1-18

1-b. Draw a polyline through the closed object. Break the closed object at the line, and move the split objects away from the line.

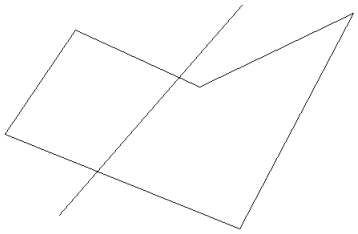


Figure 1-19

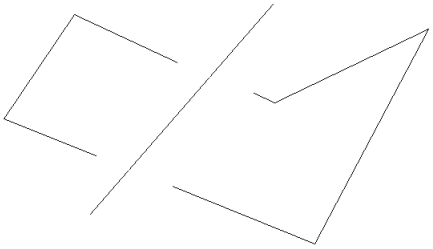


Figure 1-20

2-a. Draw a box on layer 2A. Draw a polyline on layer 2B through the box. Offset the line several times to "cross-hatch" the box. Clip off the line segments that are outside the box.

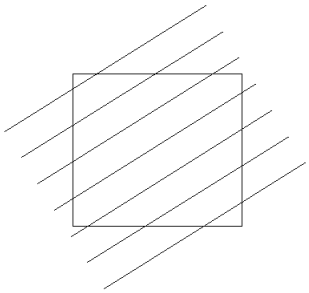


Figure 1-21

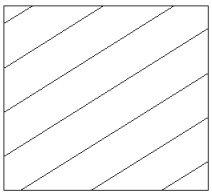


Figure 1-22

Hint: Another way of Hatching a closed area is with the Hatch command.

[Draw]-[Hatch] (This will bring up the Hatch command bar)

[Pattern]

In the pattern window choose the Lines_45 type (Do this by; left-clicking on the down arrow next to the window, selecting the Lines_45 type from the Hatch pattern dialog box, and then left-clicking on OK)

Leave the select control in the Bound window on Record and left-click on the box

In the Scale window; **100** (depending upon the size of the box)

[Pattern]

[Close] or **{ESC}**

2-b. Move the cross-hatch lines to the right side of the box using the Move command. First, move by layer name, then use the Undo command, and move the objects again by selecting the color.

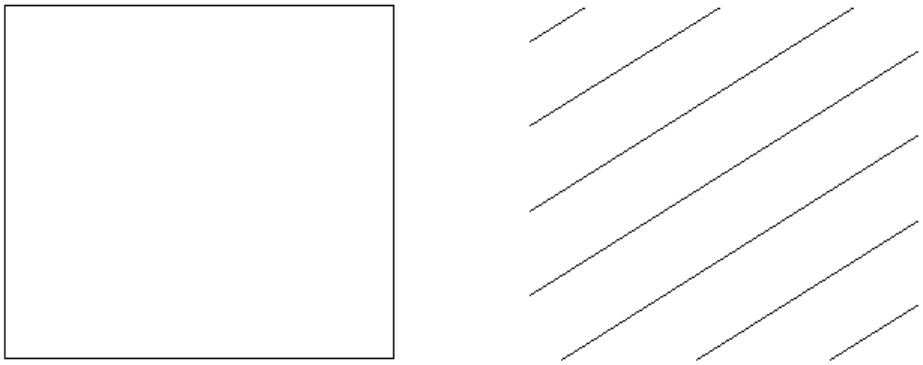


Figure 1-23

3-a. Draw a snowman on layer 3A.

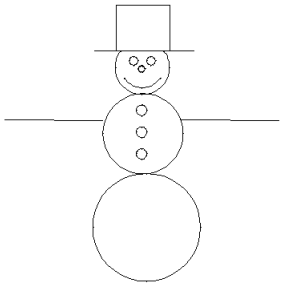


Figure 1-24

3-b. Draw a tic-tac-toe game on layer 3B. Isolate this layer. Draw one X and one O and copy these to play a game.

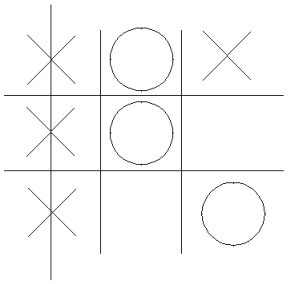


Figure 1-25

4-a. Draw a point at coordinates 0,0 on layer 4A and isolate this layer. Using the Traverse command, draw a line 50' north, then 100' east, then 50' south, then 100' west. (The points don't need to be labeled)

Figure 1-26

4-b. Setting up at point (0,0) with a backsight of N 0 E, use the Traverse command to draw a curve with a radius of 200' and a delta angle of 90 degrees. Then set up at point (0,100) with a backsight of N 0 E, use the Traverse command to draw a curve with radius of 100' and delta angle of 90 degrees. Connect the ends of the curves using the Set command.

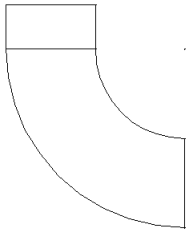


Figure 1-27

Caution: Each time the Traverse command is used, a point is created. Therefore, this command should not be used to draw the last side of a rectangle or other closed object since a duplicate point will be created. Instead, use the Set command to draw the last side of the object.